



Newsletter

Volume 4, Number 3
May - June 1987

Summer at the Arboretum ...

Members and friends are invited to the Dedication of the Perennial Garden on June 27th. Please call Janice Claiborne for information.

The Acid Rain Research Demonstration is open to the public during visiting hours. Groups may schedule a special program to be given by an IES staff scientist.

Sunday Ecology Programs will continue throughout the summer, held on the first and third Sunday of each month (excepting holiday weekends).

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See the Summer Calendar on the last page of this Newsletter for information on all of our current public programs.

The IES Newsletter is published by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the Editor.

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Hudson River Dynamics

This spring there was a massive run of shad in the Hudson River. In some years, however, only a fraction of the 1987 numbers of shad are found, and such fluctuations appear to be an ongoing phenomenon: a New York State survey from 1936 (*A Biological Survey of the Lower Hudson Watershed*, State of New York Conservation Department Supplement to 26th Annual Report) describes annual catch ranges during the 1925-1935 period of from 22,680 to 226,800 kilograms (50,000 to 500,000 pounds). What causes such variation?

To try to answer this question and others it is necessary to understand more about the ecology of the Hudson River. Institute of Ecosystem Studies scientists are studying the food web of the river ... its primary productivity, or the rate at which the sun's energy is stored as food material (primarily by the photosynthetic activity of green plants such as algae), and secondary productivity, or the rate of energy storage by consumers (animals). Recently IES Aquatic Ecologists Stuart Findlay and Michael Pace received a one-year grant from the Hudson River Foundation for a project to learn more about how the populations of these microscopic organisms are controlled by environmental factors in the river.

The free-floating zooplankton that are among the Hudson River's principal secondary producers are predominantly species of tiny crustaceans, the class of animals whose larger members include

crabs, shrimp and lobsters. These microscopic copepods and cladocerans (water fleas) feed on smaller green plants (algae) and bacteria. Zooplankton are a major food source for the larval stages of striped bass and several species of herring, including the commercially important shad. When the numbers of zooplankton are high, therefore, larval fish populations flourish.

Drs. Findlay and Pace, assisted by David Lints (page 3), are studying the productivity of the river's food web. How efficient are zooplankton at feeding on bacteria and algae? How do the physical conditions in the Hudson River affect that feeding -- can suspended sediments in the water, for example, interfere with feeding behavior? To answer these questions the ecologists sample mid-river sites near Poughkeepsie and Kingston every two weeks from early April through December. Using a pump that moves 38 liters (10 gallons) of water per minute through a fine mesh net, they collect samples of river plankton. These samples are brought back to the IES lab where preserved zooplankton ranging in size from 100 microns to 2 or 3 mm (0.0004 to 0.1 in.) are counted and their biomass calculated. Other IES scientists take samples at the same sites to calculate the densities and biomass of the river's primary producers.

Hudson River zooplankton are also maintained alive at the Findlay/Pace lab in order to investigate feeding behavior. Aquaria containing the microscopic animals as well as tagged bacteria and algae are subjected to different physical conditions, such as increased turbidity, to learn whether these factors affect grazing.

Returning to the variation in shad populations, remember that larval shad -- which are only several centimeters in length (an inch or two) and which resemble gelatinous fish with bones and big eyes -- depend on the river's secondary production to survive and grow. Shad spawn in the stretch of the Hudson in northern Dutchess and southern Columbia Counties, and the larval fish feed on zooplankton as they drift to sea; these young obviously have a better chance of survival when there are a lot of zooplankton for them to eat. Young shad spend from three to four years at sea before returning to the Hudson to spawn, so the good run this year may be an indication of a healthy zooplankton population some years earlier.

The IES ecologists are hoping to determine what controls the dynamics of zooplankton, to discover why population numbers are so variable. By putting pieces of the puzzle together, they hope to reach their goal of better understanding the ecology of the Hudson River.

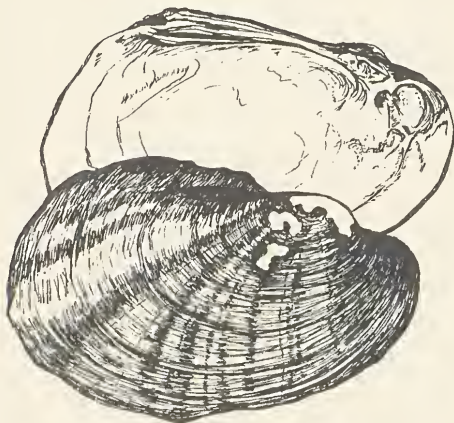


MICHAEL L. PACE

The water flea, *Bosmina* sp., is one of the zooplanktonic forms found in the Hudson River. Note the eye in the upper left, the curving gut, and two oval eggs on the right. The animal, magnified in this photomicrograph, is actually approximately 0.5 mm (0.02 in.) in length.

Pearly Mussels: Subtly Surprising

by Lauren Parmelee, Project Assistant



A pearly mussel, *Lampsilis* sp.

What local freshwater animal is beautiful on the inside, is a food source for both humans and wildlife, and has a most intriguing, if precarious, life cycle?

You might begin by guessing the more obvious possibilities: a fish or an insect. However, to discover the right answer, you must dig a little deeper into the soft substrates of the larger local rivers and lakes. There, lying partially buried in the bottom sediments, live a number of species belonging to the family Unionidae. Unionidae are more commonly known as pearly mussels because of the pearl-like quality of their inner shell. (In fact, their shell is actually made of the same substance as pearls.) These freshwater bivalves live out their adult lives relatively fixed in one spot. They obtain their food by filtering plankton from the surrounding water and, in turn, are fed upon by muskrats, mink, raccoons, fish, and historically, humans.

While maybe not all would agree that freshwater mussels are exciting research subjects, a good deal of scientific information has been published about them. Dr. David Strayer, an aquatic ecologist at the Institute, is doing studies of the ecology and distribution of these animals in the Hudson River basin.

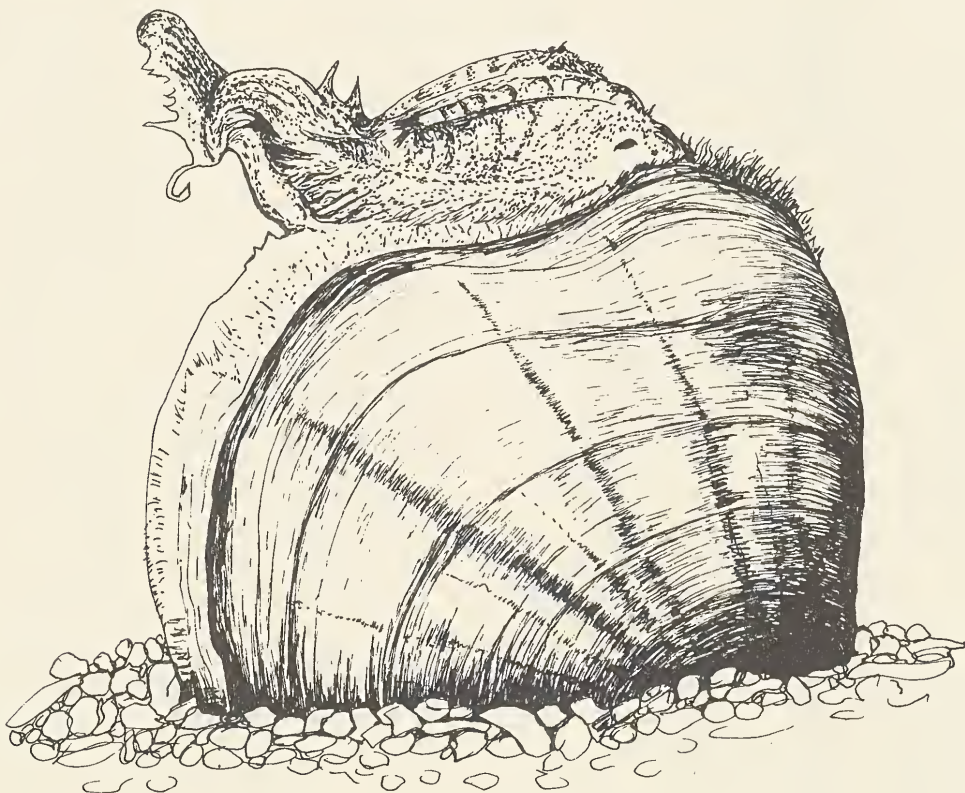
One of the most interesting aspects of the pearly mussels is their unique life history. The saltwater relatives of the unionids, which include the familiar edible blue mussel found on rocky shores, have a fairly straightforward life cycle. The female mussel releases thousands of eggs directly into the water. Some of these eggs are then fertilized by the sperm that are released by the male mussels. The fertile eggs develop into free-swimming larvae which eventually settle and grow into adults.

In contrast, freshwater mussels have a much more complex growth pattern. The female unionids also produce many eggs but, instead of being released, these eggs are transported to a series of tubes located in the gills. There they are fertilized by the free-floating sperm released by male mussels, and develop into larvae within a brood pouch called the marsupium. These microscopic two-shelled larvae are called glochidia, and, remarkably enough, they are parasitic of fish. Glochidia are unable to swim freely and, when released by the female, must locate a fish to attach to or they will soon die. The parasitic glochidium remains attached to its host fish until it develops into a miniature adult form. It then drops off, falls to the bottom, and grows. If left undisturbed, pearly mussels are able to live ten to twenty years. This is much longer than other bivalves which are known to live a maximum of only three years.

What about possible harm to the host fish? To a fish, each glochidial attachment is only a small infection, and it is possible for a fish to have many mussel larvae on it at one time. Apart from certain problems in fish hatcheries, it seems that glochidial infection is not a serious health concern for most individual fish.

The glochidia of some freshwater mussels have two tiny hooks that enable them to latch onto the fin of a passing fish. Other types of glochidia have no hooks, and develop in the gill structures of their host fish -- in order to reach the gills, they must travel into a fish's mouth. To make matters more difficult for unionids, some glochidia are only able to remain attached to certain species of fish. All in all, maturing into an adult freshwater mussel can be a tricky proposition.

There is one genus of pearly mussel, *Lampsilis*, which has evolved a fascinating method for bettering the odds of survival for its hookless glochidia. Part of the body of the egg-carrying female becomes extended into the water in such a way that there appears to be a small fish hovering over the mussel. The extent that this lure is developed varies between *Lampsilis* species, but some of these "minnows" are complete with an eyespot and/or a tail. The purpose of the lure is to attract larger hungry fish to the area. When such fish are close by, the mussel releases its glochidia, some of which may be taken up into the fish's mouth and reach the gill surface. It is a unique and amazing reproductive adaptation ... and doesn't it suggest that freshwater mussels can be exciting research subjects after all?



Lampsilis ventricosa with built-in lure.

ILLUSTRATIONS BY LISA H. BANDAZIAN

New Staff



SHARI LIFSON

THOMAS C. ALEXANDER, research assistant I, is working with IES Laboratory Manager John Eaton, collecting and analyzing data from the Institute's air quality/meteorological station. These measurements not only provide background data for current research projects but also permit the assessment of long-term trends in weather and air quality. Mr. Alexander has a bachelor's degree with American Chemical Society certification in chemistry from S.U.N.Y. College at Brockport.



SHARI LIFSON

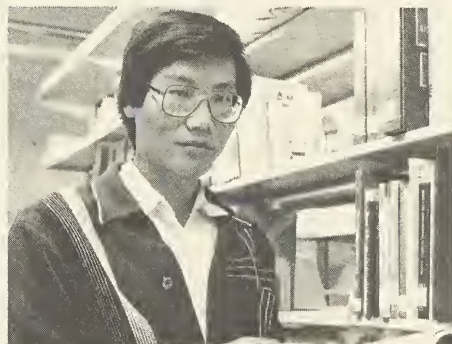
KARIN E. HOWE, research assistant I, has a bachelor's degree in biology from Cornell University. She is assisting Aquatic Ecologist Stuart Findlay in a study of the food resources in the Hudson River's Tivoli Bays, areas that are important as habitats for wildlife and feeding areas for species of juvenile fish.

DAVID LINTS, research assistant I, works with Drs. Stuart Findlay and Michael Pace on the Hudson River algae/bacteria/zooplankton study described on page 1 of this Newsletter. He is a graduate of S.U.N.Y. College at Purchase, with a bachelor's degree in ecology/environmental sciences.



SHARI LIFSON

I-FAR LIN, assistant librarian, was given a temporary appointment in October 1986 to set up a data base system for the IES library's collection on limnology (22,000 reprints). His appointment was recently extended and he is working closely with the librarian, Annette Frank. His responsibilities include such computer-related activities as putting the library 'on-line', and organizing inter-library loans. Mr. Lin received his bachelor's degree in political science from the National Chingchi University in Taiwan and his master's degree in library science from S.U.N.Y. at Albany.



SHARI LIFSON

Promotion



SHARI LIFSON

MARCIA T. DAVIS has been promoted to assistant to the education staff. Hired as education department secretary in November 1977, she spent her first month in an office at the Lee Lovelace House where one of her responsibilities included feeding a family of raccoons living behind a glass panel in an office wall! (Note: The education department moved to its present location in the Gifford House in December, 1977, and the renovated Lee Lovelace House -- minus raccoons -- is now a dormitory for students and visiting scientists.) As secretary, Mrs. Davis' responsibilities included general office tasks and overseeing the volunteer program. Now, in addition to those tasks, she is assisting the three full-time and up-to-eight part-time Education Program personnel, and is responsible for coordinating IES Adult Education Program courses and producing the program's brochures.

Dr. Likens in New Zealand and Australia

IES Director Dr. Gene E. Likens and Phyllis Likens spent February 'down under', where Dr. Likens attended scientific meetings and did research related to his programs at the Institute.

The Likens' first stop was in New Zealand, where he presented a paper at the XXIII SIL Congress (Societas Internationalis Limnologiae). From there it was on to Australia where Dr. Likens spent three weeks as a Visiting Fellow at the Chisholm Institute of Technology in Victoria, lecturing, visiting research sites and meeting with the scientific staff. During this period he presented a plenary lecture on the effects of acid rain on lake sediments at the 4th International Symposium on the Interaction between Sediments and Water, held in Melbourne.

While in Australia Dr. Likens also visited a Global Precipitation Chemistry Project (GPCP) station at Katherine, located in the outback in the Northern Territory. Dr. Likens is a participant in the GPCP, a joint program by IES, the University of Virginia and the National Oceanic and Atmospheric Administration (NOAA), and funded primarily by NOAA with some support from the Mary Flagler Cary Charitable Trust. The GPCP was begun in 1980 to sample precipitation in the remotest places in the Southern Hemisphere and compare its chemistry with that of precipitation samples from more polluted areas in the Northern Hemisphere.



PHYLLIS C. LIKENS

Judy Locke, assistant at the GPCP station in Katherine, Australia, and Dr. Likens, with rain collection apparatus.

They Quit

Institute staff members who wished to break the nicotine habit participated in "The 'Fresh Start': 21 Days to Stop Smoking" held at IES during the month of March. The program, run by Manager of Operations Owen Vose (who gave up smoking 11 years ago) had a perfect record of nine enrolled and nine graduated. This record remains intact. Program participants were: Henry Behrens (maintainer); Steve Bialousz (supervising mechanic); Janice Claiborne (assistant to the director); Bonnie Fiero (senior gardener); Allan Kling (foreman of gardeners); Dick Livellara (supervising maintainer); Bob Mulder (assistant maintainer); John Olson (gardener); and Geoffrey Parker (postdoctoral associate).

Volunteers Honored

Volunteers are active in all phases of the Institute's programs: in horticulture and at the Greenhouse, in the library, at the Gifford House in both the education program and the gift shop, in the Field Laboratory, and in laboratories at the Plant Science Building. On May 8th, a recognition dinner was held at the Plant Science Building to thank those individuals whose cheerful and able assistance makes all these IES programs run more smoothly.

Dr. Alan Berkowitz, head of education, introduced IES Director Dr. Gene Likens who showed slides and spoke of his travel and research experiences in Australia. Supervisors were then invited to the podium to present certificates to their volunteers. Dr. Berkowitz concluded the evening by giving special recognition to Hilda Messner, who worked 141 hours in the gift shop, and to Helen Vagts, who contributed 292 hours of her time to the education program.

Summer Calendar

COURSES

Fall Adult Education Program courses will begin in mid-September. Catalogues will be sent to all members and previous course participants in August. If you are not already on our mailing list and would like to receive a catalogue, call the Gifford House at the number below.

ECOLOGICAL EXCURSIONS

Fall excursions include:

- Estuarine Ecology: Canoe Exploration of Constitution Marsh
- Catskill Mountain Ecosystems
- Hudson River Ecology Cruise on the Sloop Clearwater
- Agricultural Ecology of the Mid-Hudson Valley Island and Marine Ecology in Bermuda

For details and registration information, call the number below.

SUNDAY ECOLOGY PROGRAMS

Free public programs are offered on the first and third Sunday of each month. All programs are from one to two hours long, and begin at 2:00 pm at the Gifford House unless otherwise noted. (There will be no programs over the July 4th or Labor Day weekends.)

Tentative schedule (please call the number below to confirm the day's topic):

- June 21st - A stream walk (Stuart Findlay)
- July 19th - Management for forestry, wildlife and recreation on small woodlands (Jon Kays) - Walk
- August 2nd - Life in a small pond ... some you see and some you don't! (Stuart Findlay) - Walk
- August 16th - Squish, squish, squish: A walk through a spring-fed wetland (David Strayer)

Wear long pants and sturdy footwear with socks; long-sleeved shirts are also recommended. In case of inclement weather, call the Gifford House after 1 pm to learn the status of the day's program.

ECOLOGICAL RESEARCH DEMONSTRATIONS

IES is setting up demonstrations to introduce Arboretum visitors to the methods and thinking

behind ongoing ecological research projects. The first of these to be completed is the Acid Rain Research Demonstration behind the Gifford House. Here, a series of tanks simulating natural ponds (complete with plants and animals) are exposed to different chemical treatments and the results recorded twice a week. This free demonstration is open to the public during Arboretum hours; children must be accompanied by an adult. An IES staff scientist will give special programs to groups that call the number below for an appointment.

GREENHOUSE

The IES Greenhouse performs double-duty: it is a year-round tropical-plant paradise as well as a site for controlled environmental research. The public is invited to explore both aspects during Arboretum hours. There is no admission fee, but visitors should first stop at the Gifford House (see below).

SCIENTIFIC SEMINARS

The Institute's weekly program of scientific seminars will resume in September.

ARBORETUM HOURS

Monday through Saturday, 9 a.m. to 4 p.m.; Sunday, 1 - 4 p.m. The Gift and Plant Shops are open Tuesday through Saturday 11 a.m. to 4 p.m.; Sunday 1 - 4 p.m. Closed on public holidays. All visitors must obtain a free permit at the Gifford House for access to the Arboretum.

MEMBERSHIP

Take out a membership in the Mary Flagler Cary Arboretum. Benefits include a special member's rate for IES courses and excursions, a 10% discount on purchases from the Gift Shop, six issues of the IES Newsletter each year, free subscription to *Garden* (the beautifully illustrated magazine for the enterprising and inquisitive gardener), and parking privileges and free admission to the Enid A. Haupt Conservatory at The New York Botanical Garden in the Bronx. Individual membership is \$25; family membership is \$35. For information on memberships, contact Janice Claiborne at (914) 677-5343.

For more information, call (914) 677-5359 weekdays from 8:30 - 4:30.

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